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UNITED STATES PUBLIC HEALTH SERVICE
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UNITED STATES PUBLIC HEALTH SERVICE EXHIBIT

AT THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION, SAN FRANCISCO, 1915

BY

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UNITED STATES PUBLIC HEALTH SERVICE EXHIBIT, PANAMA-PACIFIC INTERNATIONAL EXPOSITION, SAN FRANCISCO, 1915.

The exhibit of the United States Public Health Service at the Panama-Pacific International Exposition was prepared with the idea of presenting in a popular and comprehensive way, easily understood by the general public, the latest methods of preventing the common communicable diseases. The funds available for the preparation of exhibit material being limited, it was not possible to give in detail all of the many features of preventive measures recommended and used by the various organizations interested in public health work. Careful selection was therefore made of those diseases for which definite preventive measures are known and employed.

All exhibits installed were of permanent educational value, and can be utilized after the close of the exposition. In the preparation of reading matter for labels and charts great care was exercised to insure accuracy of the explanatory scientific data. In order that this data might be easily understood by the general public, simple idiomatic terms were used where possible without detracting from the necessary scientific description. The question of inclosing the exhibits in glass cases was carefully considered and a selection made of a portable case, easily taken apart and assembled. All exhibt case frames were of bronze, and only selected plate glass was used, in order to minimize refraction and reflection.

Wherever possible moving or mechanical exhibits were installed. The manner in which visitors to the exposition were attracted to the exhibit by the mechanical models fully justified their installation, and popular interest in the service exhibit was greatly stimulated by the mechanical features. Experience with mechanical models warrants the caution that they be strongly constructed and subjected to long-continued working tests before acceptance from the contractor. Simplicity of design of the operating parts is of primary importance. Constant attendance of demonstrators adds greatly to the effectiveness of the exhibit for the reason that many visitors fail to read labels but will give interested attention to a verbal explanation. If this practice is followed the real object of the exhibit is attained, and the public proportionately benefited.

Enlarged models of the various insect transmitters of disease, such as the fly, mosquito, flea, tick, and louse, attracted great attention

and were, as a rule, closely studied by the majority of visitors, leaving no doubt that a much clearer conception of the rôle played by insects in the spread of disease was thus being acquired.

While the primary object of the exhibit was, of course, to interest and instruct the general public, there was a scientific atmosphere which effectively appealed to visiting physicians and others interested in medical science. Some of the features of especial interest to the medical profession included: A series of glass models illustrating the stages in the life cycle of the *Plasmodium vivax* and models of plankton, each of which will be described under the appropriate subtitles.

The scope of the exhibit was materially enlarged by the presentation of the economics of preventive medicine. This was accomplished by reducing to terms of dollars and cents the financial loss sustained by the people of the United States as a result of the ravages of preventable diseases. To convey this lesson, charts and mechanical demonstrations were utilized.

The exhibit of the service was located in the northwest section of the Palace of Liberal Arts, and occupied a floor space of 5,252 square feet. This extensive floor area was ample for the proper grouping of the exhibit material, laboratory, and office, leaving a main aisle through the center of the exhibit. (Cut 1.)

A fully equipped office was installed, including an information bureau, where the officer in charge and his assistants were engaged in answering inquiries regarding public health work. For the benefit of those seeking detailed information title pages from all existing service publications were secured, reduced to a standard size, 5 by 8 inches, and displayed upon screens in serial order. This enabled those desirous of securing copies of publications covering special subjects to find the desired pamphlets without loss of time. Title pages of 446 service publications were displayed in this manner. Newly issued pamphlets were posted as soon as received. For immediate distribution a very limited supply of service publications was available. Bound volumes of service bulletins formed a part of the health officer's library, which contained, in addition to the literature, a large number of recent standard publications relative to public health work.

The organization of the service was epitomized upon a chart showing the work of the different divisions of the bureau, and a world map giving the exact geographical location of all stations.

An automatic device for displaying stereopticon views in daylight was in continuous operation, showing slides with explanatory titles. These slides covered a wide range of subjects, including plague, typhoid fever, malaria, hookworm, trachoma, etc. The use of titled slides eliminated the necessity of verbal explanation. Motion pic-

FIG. 1.—PARTIAL VIEW OF EXHIBIT.

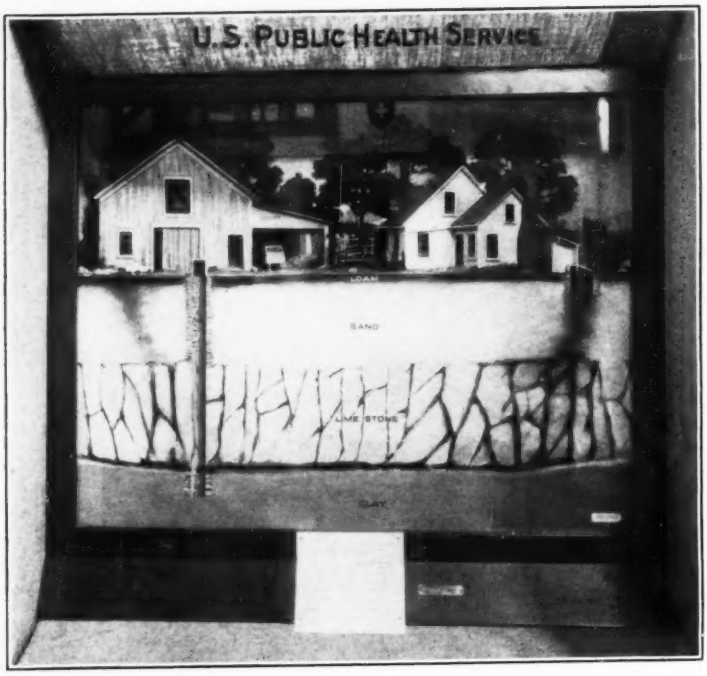

FIG. 2.—HOW A SURFACE WELL MAY BECOME CONTAMINATED.

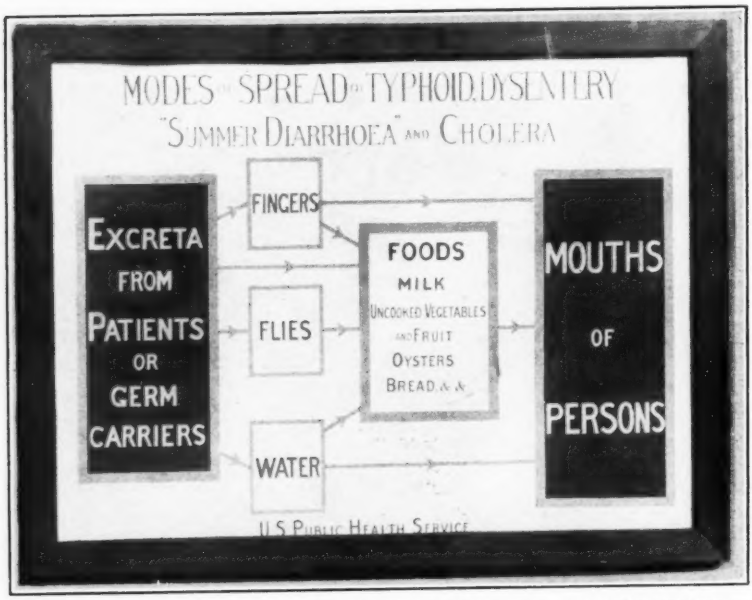

FIG. 3.—CHART SHOWING MODES OF SPREAD OF TYPHOID FEVER, DYSENTERY, SUMMER DIARRHEA, AND CHOLERA.

tures displaying certain activities of the service were regularly shown in conjunction with other Government films in the Government exhibit board lecture rooms in the Palace of Mines and Palace of Liberal Arts. The subjects covered by these reels were: Immigration work at Ellis Island; Hygienic Laboratory, Washington, D. C., and Trachoma work in eastern Kentucky.

In addition to the service exhibit described in the following pages, a service officer, with two assistant surgeons, two physicians employed by the exposition, and a staff of nurses, was in charge of the installation and administration of a fully equipped emergency hospital on the exposition grounds. The equipment of this hospital was furnished on an exhibit basis, and included two motor ambulances. During the preexposition period of construction and the 12 months of the exposition several thousand cases were treated. The library of the emergency hospital contained 1,250 latest edition textbooks on medicine, surgery, and allied sciences. These books were furnished on the exhibit basis and were available to all interested visitors.

An officer of the service was detailed by the Surgeon General, with the authority of the Secretary of the Treasury, to act as chief sanitary officer of the exposition. Two sanitary inspectors for duty under this officer were provided by the exposition authorities.

A complete mine-rescue emergency hospital was designed and equipped by the service and installed as a part of the exhibit of the Bureau of Mines in the Palace of Mines and Metallurgy. The officer in charge of the service exhibit visited this hospital daily and cooperated with the officials of the Bureau of Mines in their demonstration of rescue work following mine disasters. This work of the Bureau of Mines attracted hundreds of visitors daily, thus enabling the service officer to extend an invitation to visit the service exhibit in the Palace of Liberal Arts. This was a measure of considerable value.

A detailed description of the service exhibit follows, under appropriate sub-titles. In giving this description it has been the aim to emphasize the main features of disease prevention and to clearly show the elements concerned, rather than to dwell extensively upon the exhibit itself. It is believed that this plan will increase the usefulness of this publication.

Typhoid Fever.

From a public health standpoint, typhoid fever is one of the most important diseases of man. The infection results in the sacrifice of many thousands of lives annually in the United States, and entails great economic loss. It is a disease which is easily preventable, and wherever a high standard of typhoid prophylaxis prevails the result is a reduction not only of the typhoid morbidity itself but of the morbidity of a number of other diseases as well. Unfortunately,

high standards of typhoid prophylaxis do not universally prevail in this country. For these reasons the exhibit relating to the disease was made especially complete. It included the spread of typhoid through the medium of carriers, the relation of the house fly to the dissemination of the disease, the means of the pollution of wells, shell fish, and public water supplies, the resulting mortality, the causative organism of the infection, and the value of antityphoid vaccination as a preventive measure.

(*a*) *The story of a typhoid bacillus carrier.*—This consists of a series of six pictures illustrating the method of spread of typhoid fever by carriers. These pictures are displayed in a cabinet, so arranged that one picture at a time is shown for a period of 40 seconds. The story centers around a young woman, convalescent from typhoid fever, who returns to her work in a milk depot and infects some of her customers, one of whom dies. With the pictures are given data relating to "carriers" and the importance of periodical examinations of the dejecta of convalescent typhoid patients in order that precautions may be taken to prevent the infection of others. See reprints from Public Health Reports Nos. 58 and 174.

(*b*) *Contact infection in the spread of typhoid fever.*—Two cross sections of a boarding house are shown. The same woman serves the boarders and cares for her husband, who is ill with typhoid fever. The figure representing the woman moves from the sick room to the dining room and kitchen and back to the sick room again. In the second cross section three of the boarders are ill with typhoid and one has died, indicated by crape on the door. A descriptive label shows how this infection could have been avoided by sending the first patient to a hospital for treatment, by temporarily suspending boarding-house operations, or by the adoption of the customary precautionary measures.

(*c*) *Model of house fly in different stages of development.*—A model of a house fly accurately made, 32 times the natural size, is displayed. Fly eggs and larvæ magnified 75 times are also shown. A large number of small vials were prepared in which were fastened fly eggs, larvæ, pupæ, and adult flies. These were distributed to health officers and physicians as souvenirs, and formed a vest pocket exhibit of the life cycle of the house fly. Pictures of the life cycle of the house fly, showing the adult fly, the eggs, and the maggot stage, and labeled with the duration of each stage, are similarly displayed. The method of the spread of disease by flies is also depicted by a picture of a heap of garbage from which these insects are feeding and then journeying to the milk bottle and dishes being used by a baby seated near by.

(*d*) *Water-borne infections of typhoid.*—Ten cities of the United States having a population of more than 100,000 each were selected and the typhoid fever death rate during the last 10 years shown by a series of elevations, each sixteenth of an inch in height, representing one death from the disease. During the 10-year period each of the cities had installed some method of water purification, and the decrease in the death rates is graphically shown by the decrease in the height of the elevations. Attention is called by placards to the Mills-Reincke phenomenon—that is, the reduction in death rates from tuberculosis, intestinal diseases, and other conditions following the installation of water purification systems. See Bulletin of Hygienic Laboratory No. 89 and Reprints from Public Health Reports Nos. 128, 204, and 213.

(*e*) *Influence of public water supplies in the spread of typhoid fever.*—A topographical model showing the relationship between certain towns and villages along a water course which becomes polluted with the organisms of typhoid fever. The water intake for each town is illustrated and the number of deaths from typhoid fever in each of the communities registered. A descriptive label explains how typhoid infection is carried by streams, emphasis being laid on the fact that the factor of time,

rather than that of distance, governs the possibility of infection. This was done on account of the very general impression that streams purify themselves within a certain number of miles. The rapidity of flow of the stream is also shown to have a bearing upon the distance the infection is carried. See reprint from Public Health Reports No. 128.

(*f*) *How shellfish may become infected with typhoid fever organisms.*—This model shows a sewer discharging into a river near the seacoast. At the mouth of the river an oyster bed is located. A belt, actuated by an electric motor, slowly revolves under the surface of the water, indicating the current from the river to the oyster bed. Small black lines are painted on this belt to represent typhoid fever organisms, which apparently disappear into the oyster shells as they are opened for feeding. Shellfish infected in this manner, when consumed uncooked, may cause typhoid fever. For this reason State or Federal supervision of shellfish beds should be established. See reprint from Public Health Reports No. 181.

(*g*) *How a well becomes infected with typhoid organisms.*—A well model showing a farm scene with farmhouse, barn, and privy. The underlying geological strata from above downward are: A porous layer, fissured rock, impermeable clay, and finally water-bearing gravel. Seepage from the privy and barn passes downward through the porous layer and fissured rock, and upon reaching the impervious clay, follows this along until the well is reached, thus rendering the water contaminated. The label states that typhoid organisms are carried considerable distances in this manner, depending upon the nature of the soil, the amount of seepage, and the quantity of infectious material.

(*h*) *How a well may become infected even though precautions are taken.*—This model shows a high-class country residence with modern plumbing installed. The well is located on a higher level than the cesspool, into which the house seepage discharges, and is thoroughly protected against contamination through surface drainage. On account of the underlying strata being tipped in a slant opposite to that of the surface slope, drainage from the leaky cesspool enters the water-bearing stratum and thus renders the well liable to contamination.

(*i*) *How a surface well may become contaminated.*—This model shows a house, barn, privy, and well. The geological formation consists of loam, sand, limestone, and clay, the ground-water level being at the conjunction of the limestone and clay. In order to have water storage capacity the bottom of the well is in the clay stratum. Surface wash easily passes through the loam, sand, and limestone crevices to enter the well. Limestone strata always contain crevices of this character, thus rendering seepage possible. In this way typhoid and other organisms may easily contaminate a water supply. (Cut 2.)

(*j*) *United States typhoid death rate.*—Demonstrated by a large concrete water tank on which the scale, usually giving the depth of water, is made to show figures from 4 to 56 in serial order, these figures corresponding to the death rate per hundred thousand inhabitants in certain States. Alongside of the scale is a ladder upon which the figure of a man is made to climb by operating a valve. Upon the pointer being set to the State desired, the man climbs or descends the ladder until his extended hand points to the figure indicating the death rate from typhoid fever in that State. The figures are based upon the United States census returns for 1913 and comprise the registration States only. The States not shown do not keep complete death records.

With the preceding exhibit two charts are displayed showing in a graphic manner, by the block system, the number of deaths from typhoid fever in the registration area of the United States during 1913, arranged according to months; also the number of deaths from typhoid fever in the registration area of the United States for the year 1913, arranged according to age groups.

There is displayed as well a large map of the United States. On each State is recorded the death rate from typhoid fever of the white, colored, and total population so far as the records are available.

(*k*) *Typhoid fever bacilli.*—A transparency of *B. typhosus* is displayed on a standard 3½ feet high, the label explaining that it is the organism causing typhoid fever and that the germs are sometimes found in the discharges of those who have recovered from the disease. On the same standard there are shown dimensional glass models of *B. typhosus*, flagellated and nonflagellated, with explanatory data regarding the preparation of antityphoid vaccine and the methods of preventive treatment. See reprints from Public Health Reports Nos. 42 and 80.

(*l*) *Value of antityphoid vaccination in preventing typhoid fever.*—A chart under this heading gives the number of cases of typhoid fever occurring in the United States Army during the four-year period ending in 1913, contrasting the cases and deaths before and after compulsory antityphoid vaccination was introduced. There is similarly displayed a large balancing scale with a weight representing 2,000 cases of typhoid fever with 248 deaths among 10,750 soldiers without vaccination, and a proportionate opposing weight representing 2 cases of typhoid and no deaths among 20,000 vaccinated soldiers.

(*m*) *Modes of spread of typhoid, dysentery, "summer diarrhea," and cholera.*—A chart depicting the spread of infection from the excreta of patients or germ carriers, by means of fingers, flies, or water, to milk, uncooked vegetables, fruit, shellfish, and other foods, and thence to the mouths of persons, the course of the infection being shown by arrows. (Cut 3.)

(*n*) *Diarrheal disease under 5 years.*—A chart bearing this label shows by the block system the number of days illness in a filthy area during a certain period of time, comparison being made with the far lesser number in a flyless area.

Cholera.

This subject was treated by dimensional models of the comma bacillus and a map showing the means of dissemination of the disease in the Hamburg epidemic.

(*a*) *How cholera was spread by a public water supply.*—A large map of Hamburg and Altona, Germany, is displayed with this caption. The red line on the map indicates the boundary between the two cities, which were in fact one. The water supply of Hamburg was taken from the River Elbe unfiltered, while that of Altona was from an entirely different source. The black dots indicate the cases of cholera. Cholera, being a water-borne disease, was almost entirely confined to the limits of Hamburg, although only an imaginary line separates the two towns.

(*b*) *The organism of cholera.*—Dimensional models of the cholera vibrio are shown, with which is given information concerning the epidemiological features of the disease. See reprints from Public Health Reports Nos. 52 and 75.

Water.

Water pollution having been treated under the subject of typhoid, further consideration was given to it as an agent of infection through the medium of models of plankton, showing the many different forms of animal and vegetable life which water contains, the methods of chemical disinfection of water to prevent the transmission of disease, together with data regarding the cost of operation of such plants, and the outfit required for collecting samples and making bacteriological analyses.

(*a*) *Models of plankton—Minute forms of animal or vegetable life found in water.*—Recent studies have shown that the degree of pollution of water may be quite closely determined by microscopical examination, undertaken to ascertain the nature of the

FIG. 4.—CARCHESIUM. ONE OF THE FORMS OF PLANKTON FOUND IN SEWAGE POLLUTED WATER.

FIG. 5.—RIVULARIA. ONE OF THE FORMS OF PLANKTON FOUND IN PARTLY PURIFIED WATER.

FIG. 6.—OEDOZONIUM. ONE OF THE FORMS OF PLANKTON FOUND IN PURIFIED WATER.

FIG. 7.—HYPOCHLORITE APPARATUS.

minute animal and vegetable organisms found therein. Twenty-four blown-glass models illustrating these various plankton are displayed. These organisms are shown in their natural colors, and the exhibit therefore is very beautiful from an artistic standpoint. The models are arranged in three groups. The first group consists of those found in highly polluted water; the second those found in water with a moderate degree of pollution; and the third those present in clean water.

Group 1. *Organisms of sewage-polluted water.*—Includes Bodo Saltans, Sphærotilus, Saprolegnia, Limnodrilus, Euglena, Beggiatoa, Paramœcium, and Carchesium. (Cut 4.)

Group 2. *Organisms of partly purified water.*—The sewage organisms are gradually replaced by others—Difflugia, Cladophora, Rotularia, Arcella, Cyclops, Vorticella, Hydrodictyon, and Anabæna. (Cut 5.)

Group 3. Further purification results in the elimination of sewage organisms owing to the exhaustion of their food supply. They thus give place to such clean water organisms as Asterionella, Closterium, Odogonium, Planaria, Spirogyra, Navicula, Staurastrum, and Gomphonema. (Cut 6.)

(*b*) *Chemical disinfection of water.*—An emergency hypochlorite plant for the disinfection of water is installed and actually operated. This plant is made of empty vinegar barrels and other materials easily obtainable in any community. It consists of barrel "A," or mixing container, in which the chloride of lime or bleaching powder is stirred in water and allowed to settle for 24 hours, and barrels "B," the dosing containers into which the solution from "A" is drawn and diluted with water. With the exhibit is given information relative to the amount of the chemical to be used. See reprint from Public Health Reports No. 225.

(*c*) *Portable hypochlorite plant and full equipment for its administration.*—This plant was designed by the Minnesota State Board of Health for immediate shipment to localities suffering from water-borne epidemics or where water supplies are known to be contaminated. The plant will consistently treat water supplies distributing 1,000,000 gallons per day, and under ordinary working conditions can be set up and put into operation within an hour's time. The cost will not exceed $50. The above-mentioned plant is described in detail in reprint No. 261, Public Health Reports. (Cut 7.)

(*d*) *Traveling outfit for collecting bacteriological samples.*—This outfit, consisting of petri dishes, agar tubes, pipettes, bottles, etc., was devised by the State Board of Health of Minnesota to be used in enforcing amendment No. 6 to the interstate quarantine regulations, providing that water furnished by common carriers on passenger cars, vessels, or vehicles operated in interstate traffic shall be certified by the State or municipal health authority within whose jurisdiction it is obtained as incapable of conveying diseases. See reprints from Public Health Reports Nos. 126, 191, and 232.

FIG. 7.—HYPOCHLORITE APPARATUS.

Sewage Treatment and the Disposal of Excreta.

The proper disposal of sewage constitutes one of the great sanitary problems of the day. Especially is this true in rural communities, where soil pollution constitutes a hazard of country life. Every effort was therefore made to have the exhibit indicate not only the dangers of insanitary practices, but the remedies therefor.

(*a*) *Sewage treatment plant.*—This comprises a device consisting of the following: (1) A diversion manhole. (2) An Imhoff tank. (3) A dosing chamber. (4) A sand filter. Sewage is passed into the diversion manhole, making it possible to lead the material past the Imhoff tank when repairs are in progress. Under ordinary circumstances the sewage flows from the diversion manhole into the Imhoff tank. The purpose of this tank is to remove and hold the solids until they decompose and are rendered unobjectionable. This unobjectionable sludge then passes into the dosing

chamber which regulates its flow to the sand filter. The digested sewage passes through the sand filter and is rendered free from disease-bearing organisms. When the sewage leaves the filter tank it is clear and unobjectionable.

(*b*) *L. R. S. privy.*—A sectional model of a specal type of privy known as the L. R. S., for use in connection with suburban and country homes. The principal features of this privy are a tight container to receive and liquify the excreta, a covered water-tight vessel to receive the outflow, a zinc-lined tight box to fit easily on the top of the liquifying container and provided with an opening on top for the seat, with automatically closing lid, and an antisplashing device, together with a connecting pipe. The advantages of this privy are the simple and inexpensive construction, the liquifying of fecal material, thus reducing its volume so that it may be safely disposed of more easily and cheaply than night soil of other privies, the lessened odor, the elimination of flies and mosquitoes, and the diminished labor of cleaning. The privy may be made of either wood or concrete. See Public Health Bulletin No. 51, page 46.

(*c*) *The sanitary privy.*—Model of a sanitary privy for installation in rural communities. The following are the essential features of this privy: A closed box under the seat in which to place the receptacle for the excreta, where it may be safeguarded to prevent soil pollution; a room for the occupant; proper ventilation, and a water-tight tub, half barrel, pail, or galvanized can, placed in the box under the seat. The receptacle should be high enough to reach nearly to the seat and deep enough to prevent splashing. It is held in place by cleats nailed to the floor so that it will always be properly centered. The back of the privy should be kept closed and a box of sand or ashes provided to cover the excreta. Lime, petroleum or creosote, 5 per cent solution, may be used for this purpose. See Public Health Bulletin No. 37.

(*d*) *A sanitary pail.*—This model shows a satisfactory sanitary pail for the collection of human excreta in places where modern sanitary plumbing is not available. See reprint from Public Health Bulletin No. 138. (Cut 8.)

(*e*) *Soil pollution and excreta disposal.*—Illustrated by charts.

Chart No. 1. This chart depicts insanitary conditions of a well and privies in a well-known American city. On the same chart is a view entitled, "A back yard in a factory town." These pictures show how soil pollution results and spreads typhoid fever, hookworm, dysentery, and diarrhea.

Chart No. 2. Includes pictures of insanitary farm and school privies. Accompanying it is the statement that no farm with privy of this character should be permitted to sell milk, as typhoid and other diseases are frequently spread from such outhouses. Hookworm is an infection also received from school privies of this character.

(*f*) Samples of the products of municipal sewage plants, garbage reduction works and water filtration systems are displayed in a specially designed open case. The 24 samples include fresh grit, oxidized grit, grit after ignition, digested Imhoff sludge, dried Imhoff sludge, Dortmand tank sludge, chemically precipitated sludge from horizontal-flow sedimentation tanks, screens, scums, lime and iron sludge from water filtration plants, garbage, tankage, and industrial wastes.

Hookworm.

This subject was treated by a series of maps, charts, and transparencies.

Chart 1. A map is displayed showing all the verified locations of hookworm infections throughout the entire world.

Chart 2. A map of the United States shows by the shading of the different States the distribution of the infection in this country.

Chart 3. A greatly enlarged picture of the male and female *Necator americanus* or American hookworm. Also an enlarged diagram of the tail of the male worm.

Chart 4. This chart shows a greatly enlarged diagram of the head, mouth, including a deep view of the mouth, and the tail of the female hookworm.

Chart 5. Ten stages in the development of the embryo hookworm, showing the egg at different periods, including a fully developed embryo in the egg, a free embryo, and an unsheathed embryo. This chart explains how the eggs are laid in the small intestine, discharged in the stools, the manner of their spread by soil pollution, and the invasion of the human system.

Chart 6. This chart shows highly magnified sections through the skin, glands, lung, heart, and trachea in which hookworms are visible.

Chart 7. This chart shows the young hookworm in the intestine and larynx; also a greatly enlarged diagram of a hookworm attached to the wall of the intestine.

Chart 8. A photograph of a family of seven, all of whom are infected; also comparative photographs of two boys each 18 years of age, one being infected with hookworm and the other healthy. A third photograph of a young man of 21 years, having the appearance of a boy, is also shown.

Transparencies.—Five brass-framed transparencies showing (1) Adult hookworms, (2) eggs, (3) larvæ, (4) larvæ passing through the skin, (5) adult worm attached to the small intestine, are shown, appropriately labeled. With each transparency is given detailed information regarding the particular stage of development, the conditions favorable for growth, the means of introduction into the system, the effects thereof, and the economic significance of the infection. See Public Health Bulletin No. 32, and reprint from Public Health Reports No. 113.

Hookworm treatment results.—There are displayed 216 vials, each containing hookworms secured from a single treatment.

Intestinal Parasites.

Brass-framed enlarged transparencies of the following intestinal parasites were displayed, together with data regarding their occurrence, significance, and manner of development.

(*a*) *Lamblia intestinalis.*—The house fly carries the spores of this parasite from the contents of surface privies to food. The entire life cycle is passed within the human body; therefore if this organism is found in the intestinal discharges of a human being it is conclusive evidence that the intestinal discharges of some other person have been taken into the mouth, either by food, or in some other manner. In communities where hookworm and other intestinal parasites are common, the presence of lamblia in intestinal discharges constitutes proof of the exposure to the infected excreta of other persons. See reprint from Public Health Reports No. 154.

(*b*) *Cochin China worm* (*Strongyloides stercoralis*).—This small worm presents two generations, first, parasitic or intestinal, and second, the free living or fecal form. The intestinal form is represented only by females about one-twelfth of an inch long. They usually live deep in the mucous membrane of the intestine and the eggs, which are strung out in a chain, but otherwise resemble hookworm eggs, are deposited in the intestinal wall. The embryos hatch from the eggs inside the intestine. Under certain conditions the embryos develop into the free living forms where both males and females are present.

(*c*) *Pin worm* (*Oxyuris vermicularis*).—The male worm is about a sixth of an inch long and the female a trifle less than one-half an inch in length. The eggs are thin-shelled and have a coiled embryo. If the eggs are swallowed by a human being the adults develop in the small intestine. The males then die and the females migrate to the region of the appendix where they remain until they reach maturity. They then travel to the lower bowel, where they deposit their eggs. The diagnosis of this infection is better made by examining the intestinal discharges for the white thread-

like females which are expelled after the use of purgatives than by searching for the eggs with the microscope.

(*d*) *Whip worm* (*Tricocephalus trichiuris*).—This is a common intestinal parasite in both temperate and tropical climates. The male is about two inches long, being a little shorter than the female. The whip worm prefers to live in the neighborhood of the vermiform appendix, and its presence possibly paves the way for the entrance of disease-producing germs present in the intestinal contents, predisposing to an attack of appendicitis.

(*e*) *Round worm* (*Ascaris lumbricoides*).—The male worm is from 5 to 8 inches and the female worm from 7 to 15 inches long. They usually live in the upper part of the small intestine; hence they are occasionally found in vomited matter. The body of the worm is striated and resembles the ordinary earth worm but is more grayish than red. The eggs leave the body with the intestinal discharges and after a period of from weeks to several months, according to temperature, develop into the embryos which remain in their shells until swallowed by man or animal. The embryos then leave the egg shell and develop in the small intestine into male and female worms.

(*f*) *Entameba coli.*—This parasite is regarded as harmless by most observers. Its presence in intestinal discharges of human beings may be confounded with other forms of amebæ which cause serious diseases. An ameba has been described as the cause of pyorrhea alveolaris or Rigg's disease, and emetin has been used with success in its treatment.

(*g*) *Entameba hystolitica.*—This organism causes amebic or tropical dysentery. When present in the human intestinal canal it bores its way into the mucous membrane of the large intentine and produces ulceration. It is also found in the liver abscesses occurring in the tropics. Emetin, one of the active principles of ipecac, administered by hypodermic injection, destroys this parasite in the human body and is a specific remedy for the disease. See reprint from the Public Health Reports No. 212.

(*h*) *Beef tapeworm* (*Tinea saginatta*), *head.*—This is one of the most common forms of tapeworm found in the United States. Man is infected by eating improperly cooked beef. The adult worm is 10 to 25 feet long and has several hundred segments. The larval stage almost never occurs in man, therefore this tapeworm is not nearly as dangerous to life as the *Tinea solium*. When meat is properly cooked the eggs are destroyed and infection is prevented.

(*i*) *Beef tapeworm* (*Tinea saginatta*), *segments.*—Segments of this tapeworm near the head are sexually immature. Segments located near the tail of the worm are mature and contain eggs. These segments may rupture and discharge the eggs within the intestinal tract, or they may break loose and pass out with the intestinal discharges. This often occurs because each segment has the power of individual movement.

(*j*) *Pork tapeworm* (*Tinea solium*), *head.*—This is a very dangerous parasite. Pork infested with this worm, known as "measly pork," contains small cysts in which are found the larval form of the tapeworm. When infected pork is eaten, the embryos in these small cysts may penetrate the stomach or intestinal walls of the person, be carried to the brain, eye, or other important organ and increase in size, thus producing convulsions, blindness, or even death.

(*k*) *Pork tapeworm* (*Tinea solium*), *segments.*—The segments of this tapeworm have only 5 to 10 uterine branches. Segments near the head are immature while those more distant are mature and contain the eggs. When the mature segments and ova are expelled from the bowels and swallowed by the hog, the six hooked embryos are liberated and finally become encysted in certain muscles, forming what is known as "measly pork."

(*l*) *Russian tapeworm* (*Dibothriocephalus latus*).—This is called the broad tapeworm. It has a small olive-shaped head, with two grooves on each side. When fully developed the worm is about 30 feet long and its body may be composed of as many as 3,000

segments. It is a common parasite in Switzerland, Japan, Scandinavia, and Russia. Infection is acquired by eating improperly cooked fish. It is said that salting, smoking, or other methods of preserving fish will not kill the eggs of the tapeworm if present. The mature segments, most distant from the head of the worm, are nearly square, being about one-half inch wide, and are filled with eggs. The embryo can swim in water by means of little cilia or hairlike processes, and when swallowed by fish, infects them, thus completing the cycle from fish to man and from man to fish.

(*m*) *Dwarf tapeworm* (*Hymenolepis nana*).—This is the most common tapeworm in the United States. Infection is largely confined to children, among whom it may cause marked nervous symptoms. The worm is one-fourth to one-half inch in length, the head having four suckers. When infection occurs, the embryos bore into the mucous membrane of the intestine and undergo full development, after which they drop into the intestinal canal, adding new parasites to those already present. For this reason the infection is usually heavy.

Eggs of the Common Intestinal Parasites.

The eggs of the following intestinal parasites encountered in the examination of intestinal discharges were illustrated by glass models. Each of the egg models was 400 times larger than natural size.

Liver fluke (*Fasciola hepatica*).
Pork tapeworm (*Tinea solium*).
Beef tapeworm (*Tinea saginatta*).
Dwarf tapeworm (*Hymenolepis nana*).
Round worm (*Ascaris lumbricoides*).
Pin worm (*Oxyuris vermicularis*).
Hookworm (*Necator americanus*).
Whip worm (*Trichocephalus trichiuris*).

Miscellaneous Parasites.

Transparencies of the following parasites were also shown with descriptive labels:

(*a*) *Hydatid tapeworm* (*Tinea echinococcus*).—This is one of the smallest known tapeworms, being only about one-sixth of an inch in length. The head has four suckers, and there are but three or four segments to the entire worm. In the larval stage, on the contrary, it is much larger than that of any other tapeworm, sometimes reaching the size of a child's head. The adult stage of the parasite is passed in dogs, from which man contracts the infection. Should the egg-bearing segment be accidentally taken into the stomach of man, hundreds of larvæ may be produced. These larvæ, after boring their way through the alimentary canal, reach the liver, causing hydatid disease, which is very fatal.

(*b*) *Blood flukes* (*Schistosomum*).—There are three varieties of this blood fluke.

1. *Schistosomum hæmatobium*, the eggs of which cause the disease known as bilharziasis, in which blood is passed in the urine, from irritation by the terminal spine of the egg.

2. *Schistosomum japonicum*, which is found in the arteries and veins of infected human beings. Its eggs produce disturbances of the liver and spleen, resulting in a weakened condition of the affected person. The egg of this fluke has no spine.

3. *Schistosomum mansoni*, which is very similar to *S. hæmotobium*. The egg of the *S. mansoni* has a lateral spine, while the egg of the *S. hæmotobium* has a terminal spine.

(*c*) *Bancroft's filaria* (*Filaria bancrofti*).—This is the most common of the filarial worms and is a frequent infection in South China, India, the West Indies, and the

Pacific Islands. The embryo forms are called the *Filaria sanguinis hominis*. They are covered with a sheath and are found in the blood only during the night time. This species of filaria is the cause of elephantiasis, chyluria, lymph scrotum, etc. These diseases result from injury to the adult female worm, which is about 3 inches long, and the consequent release of immature eggs in which the larvæ are coiled. The eggs, having a greater diameter than the larvæ, stop up the lymphatic vessels and thus produce the diseases mentioned. The parasite is transmitted from man to man by the mosquito, especially *Culex fatigans*. The embryo, taken up by the mosquito, wriggles out of its sheath in the mosquito's stomach, bores its way through the wall, reaches the biting parts and finally is transmitted to another human subject, through the wound made by the mosquito in biting.

(*d*) *Trichinella spiralis*.—This parasite is the cause of trichinosis, a disease which results from eating raw or improperly cooked pork. The adult male worm is about one-sixteenth of an inch long. The females bore into the mucous membrane of the intestine and begin to produce embryos to the number of more than 1,000 to each worm. These embryos are distributed by the blood stream and lodge in the striated muscles, those which do not reach such tissues failing to develop. They there become encysted, and when poorly cooked pork infected with these parasites is eaten by man, the embryos contained in the small cysts develop in the upper part of the small intestine into mature worms. The female worms then deposit their embryos, which migrate to the striated muscles. Encysted trichinæ may remain alive twenty years. See Public Health Bulletin No. 1.

Malaria.

The exhibit relating to malaria was intended to show the means of transmission of the disease, the habits, life cycle, and internal anatomy of the malaria mosquito, together with its distribution. Glass models showing the life cycle of the *Plasmodium malariæ* in both man and the mosquito were also displayed. Explanatory descriptive labels accompanied each group.

(*a*) *The malarial mosquito* (*genus Anopheles*) *contrasted with other genera* (*Culex*.)—The habits and life cycle of the Anopheles mosquito are graphically represented by an enlarged model, mounted in a case illustrating a typical breeding pool. The water is shown surrounded by the usual vegetation found in swamp areas. An adult mosquito is poised at the edge of the water ready to fly. Floating on the surface of the water are models of the eggs of Anopheles, and suspended below the surface, in order that it may be viewed by the spectator, is an enlarged model of the "wiggler" stage of this mosquito. For the purpose of comparison, enlarged models of the eggs and larvæ of the Culex mosquito are also placed in this group, so that the existing differences may be noted.

The Anopheles mosquito is a semidomestic insect found either in or near houses and in fields and swamps. The adult mosquito does not ordinarily fly more than half a mile from its breeding place, although it may be carried a considerable distance by winds. The adult female mosquito deposits her eggs on the surface of the water, where they float separately on their sides, supported by air rafts. In a day or two the eggs hatch out into larvæ or "wiggle tails." Although the larva lives in the water, it is a true air breather. Ordinarily the larval form rests and feeds at the surface, where it lies in an almost horizontal position, its tail touching the surface of the water, while it breathes through a short tube. After about a week in this larval stage, it changes into the form known as the pupa. The pupa has no mouth parts and does not feed, remaining quietly at the surface, except when disturbed. This stage lasts usually two or three days and is ended by the birth of the adult winged insect. The adult female of this variety of mosquito transmits malaria by taking

blood from a person sick with the disease. The blood obtained by the mosquito contains the plasmodium malariæ which undergoes development in the body of the female and is transmitted to the next human being bitten, after an interval of possibly ten days.

The larva of the Culex is more active and feeds near the bottom of the water, but must come to the surface every minute or two for air. When it approaches the surface it remains at an angle of 45° thereto. The Culex eggs are deposited together in large numbers, forming a raft which floats upon the surface.

The manner in which mosquitoes manage to pass through the winter varies with the species. The Anopheles hibernate in sheltered cellars or dark nooks. Other species—for example, the Culex—survive through the power of the larva or egg to resist cold, either being capable of hatching after having been frozen.

(*b*) *The anatomy of the mosquito.*—A large bronzed framed transparency is displayed showing the internal anatomy of a female Anopheline (*A. maculipennis*). All parts of the body, both external and internal, are labeled, so that the structure of the entire mosquito may be easily understood.

(*c*) *Distribution of Anopheles.*—A large map of the United States is displayed showing by different types of shading the distribution of Anophelines throughout the country, the following species being represented: *Anopheles punctipennis, Anopheles pseudopunctipennis, Anopheles crucians, Anopheles quadrimaculatus,* unclassified *Anophelines.*

(*d*) *Mosquito breeding.*—Mosquitoes are propagated in a large glass tank over which is constructed a framework of glass and bronze wire screen. A constant supply of mosquitoes is kept in this tank, so as to show the actual living specimens and the various stages of development. A descriptive label explains the manner of life, breeding, and feeding habits.

(*e*) A series of six glass jars designed to illustrate various methods by which mosquito breeding can be avoided is displayed. The labels on these jars read as follows:

1. The water in this jar has been covered by a film of kerosene. The female mosquito will not deposit her eggs in water thus treated. If larvæ, or wigglers, are present before the oil is applied, they will be killed, as the film of oil prevents the immature forms from breathing, by stopping up the breathing siphon when they come to the surface for air.

2. The water in this instance has been treated with larvacide, this liquid being a preparation of crude carbolic acid, caustic soda, and rosin. It is somewhat poisonous and should not be placed where the water is used by man or animals. It is very useful in small swamp areas, since it does not evaporate as rapidly as oil.

3. Goldfish have been placed in this collection of water. Enormous numbers of mosquito eggs and larvæ are destroyed by small fish, especially of the type known as the top-minnow, the technical name of which is *Ginardinus pœciloides.*

4. Salt has been added to this water to prevent mosquito breeding. Most varieties of mosquitoes do not breed in water containing saline matter in solution. Some varieties, however, will breed in saline water unless the amount of salt is equal to or greater than that in sea water.

5. The water has been removed to show the drainage of pools. Where this can be done it constitutes one of the best methods of eliminating the breeding places of mosquitoes.

6. The water has been replaced by sand, to show the most satisfactory method of getting rid of mosquitoes, that is, by filling up collections of water, where these measures are practicable.

(*f*) *Malarial transmission.*—The classical experiments in connection with the early work of Manson and others in proving the manner in which malaria is transmitted are brought into personal perspective by the display of one of the original mosquito cages used by these investigators. The label on this cage explains how several investigators

spent three months in a mosquito-proof hut at Ostia, a very malarious region near Rome, Italy. During the day, the time was passed mostly out of doors, but early in the evening the observers retired to their screened hut and there spent the night. None of them developed malaria, although many living in the same locality, without protection from mosquitoes, suffered severely from the disease. Dr. Patrick Manson in England believed that this experiment was not appreciated by the public because it was performed in a malarious country and upon his request mosquitoes which had been fed upon a case of malaria were forwarded from Ostia to London. The insects were then allowed to bite certain individuals who had not previously been exposed to malaria and in due time both of these persons developed the disease, the parasites being discovered in their blood.

(*g*) *Plasmodium malariæ*.—Twenty-six glass models demonstrating the life cycle of the *Plasmodium vivax* are displayed in consecutive series, showing the development of the minute animal parasite which causes malaria from the time it is introduced into the human system by one mosquito until it is again taken from the human blood by another mosquito. These models are numbered from 1 to 15, inclusive. The stages of development through which the parasite passes in the body of the mosquito are also shown, together with its method of reintroduction into another person. These models are numbered from 16 to 25, inclusive.

1. Normal human blood corpuscle, magnified 5,000 diameters.

2. Malarial parasites as they appear free in the blood stream. A young parasite, spore, or merozoite, compact in structure and without pigment grains, with the cytoplasm arranged in crescent form and a nucleus surrounded by an "achromatic zone." An older parasite with several pseudopodia, nuclear material scattered, and pigment grains.

3. Blood corpuscle with malarial parasite. The ring-shaped pseudopodium of the parasite surrounds the base of the corpuscular mound which it produces on the surface of the red corpuscle.

4. Red blood corpuscle with malarial parasite "feeding on its substance."

5. Red blood corpuscle with a larger malarial parasite surrounding a colorless (dehæmoglobinized) mound.

6. Corpuscle with a parasite which has thrown out a second ring-shaped pseudopodium, and containing also a much older parasite feeding from two mounds, both of which are represented as almost decolorized.

7. Corpuscle with a still older parasite surrounding two entirely decolorized mounds.

8. A large, free, migrating parasite. After more or less completely exhausting one corpuscle the parasites may transfer themselves to others until they attain their maximum size.

9. A young parasite attached to the periphery of a corpuscle.

10. Corpuscle with two ring-shaped parasites. Double infection, from the so-called conjugation stage. As many as five parasites may thus be found in one corpuscle.

11. Mature parasite in a corpuscle. The nuclear material broken up preliminary to the division of the entire mass of the parasite into a large number of spores or merozoites.

12. Division of the parasite into merozoites, 15 to 18 in number.

13. Merozoites, the liberation of which completes the asexual cycle in the human blood.

14. The Microgametocyte, or male form. Certain of the mature parasites do not divide, but form sexual bodies.

15. The Macrogametocyte, or female form. Both the male and female forms of the parasite must be taken by the mosquito in order that further development of the plasmodium may occur in her body. The mosquito is then infected and is capable of transmitting the disease to human beings. Persons who have suffered from malaria for a considerable period harbor numerous parasites which have reached the stage

of development where the male and female forms are present, and it is from such individuals that the disease is most likely to be transmitted.

16. Micrometocyte free from the corpuscle and throwing off the slender microgametes.

17. Macrogamete free in the stomach of the mosquito. The reduction nucleus has been thrown off.

18. Fertilization of the compact, spherical macrogamete by the small thread-like microgamete or sperm.

19. The ookinete or fertilized cell which has become elongated and motile.

20. Ookinetes shown in contact with the stomach of the mosquito. Penetrating to the external lining of the stomach of the insect, they round up and divide, forming cysts, illustrated in several stages of growth. Magnified 2,000 diameters.

21. The stomach of the mosquito, with numerous such cysts. Magnified 75 diameters.

22. Section of a mosquito's stomach with malarial cysts further advanced. Within the ripe cysts thousands of minute spindle-shaped spores (sporozoites) are produced. These are set free within the body of the mosquito.

23. Sporozoites, the stage in which the parasite is reintroduced into the blood of man through the body of the mosquito.

24. Same as 23.

25. Salivary glands of a malarial mosquito, showing sporozoites within the glandular cells. It is by moistening her biting parts with the saliva from these glands when she feeds that the sporozoites are introduced into the human being.

Rural Hygiene.

The exhibit relating to rural hygiene comprised models of sanitary and insanitary farmhouses and sanitary and insanitary country schools.

(*a*) *A sanitary and insanitary farmhouse.*—This model shows a typical farmhouse constructed without special attention to sanitary environment. Mosquito and fly breeding places are present. A surface privy allows the soil to become infected with the organisms of typhoid fever and the eggs of hookworm. The house is not screened and the well may easily become contaminated on account of its poor location and construction.

Contrasted with this, and making up the other half of the model, are a sanitary farmhouse and surroundings. This house is constructed so that air, light, and sunshine may enter freely, and an outdoor sleeping porch is provided. There is an "L. R. S." privy in which the fecal matter is reduced by biological processes before being discharged. The well is provided with an iron casing and a concrete upper cap to prevent contamination by surface drainage. There are no roof gutters except over the doors. The house is screened and the grounds are drained to prevent mosquito breeding. See reprints from Public Health Reports Nos. 28, 37, 42, 127, 170, and 183, and supplement to Public Health Reports No. 11.

(*b*) *Sanitary and insanitary rural schools.*—The model shows an insanitary rural school portraying conditions which are found far too frequently in country districts. No attention has been paid to proper lighting or sanitary environment. The surface privy pollutes the soil and exposes the pupils to infection from hookworm and other intestinal parasites. Flies breed in the manure in the horse shed and may transmit typhoid fever. The well is so located that surface drainage from the privy and stable may contaminate the water supply. Water in gutters, pools under downspouts and other places, offer favorable breeding places for mosquitoes. No provision is made for

physical exercise. The lack of individual drinking cups favors the transmission of disease.

Contrasted with the insanitary school and making up the other half of the model is a sanitary country school. This building is constructed with a view to proper lighting and ventilation. The privy is of proper type and prevents soil pollution. The horse shed is kept clean and the manure is cared for in a covered bin to prevent fly breeding. The water supply is from a driven well, encased with concrete upper cap to avoid contamination by surface drainage. The surrounding ground is drained so that there may be no breeding places for mosquitoes. A playground and school garden are provided.

See reprints from Public Health Reports Nos. 37, 42, 116, 144, and 177. Also supplement to Public Health Reports No. 6.

Bubonic Plague.

The exhibit relating to plague comprised maps showing the distribution of the disease throughout the world; models of the common species of rodents, with information concerning their habits, economic importance, and eradication through the proper disposal of garbage and other wastes, and the rat proofing of buildings; types of rat-proof vessels and rat-proof wharves and warehouses; models of rat-proof stables, groceries and other buildings compared with nonrat-proof structures; methods of rat proofing; models of the flea, the intermediary host of plague; glass models and transparencies of *Bacillus pestis;* pathological specimens of plague infected animals, together with various methods of squirrel destruction.

(*a*) The distribution of plague, both rodent and human, throughout the world is shown on a large map upon which all plague foci are indicated. The lines of travel over which plague spreads from one focus to another are demonstrated on a Mercator's projection map of the world.

(*b*) *Mus norvegicus, the Norway or common brown rat.*—This rodent is also known as the wharf rat and the sewer rat. It is a great traveler by ships and when introduced into a locality it rapidly becomes the dominant species, destroying all other rats. It invariably lives in and about human habitations. It is not fastidious in its feeding habits and consumes garbage and offal when other foodstuffs are not available. It is essentially a burrowing animal, but possesses agility in the matter of climbing, jumping, or swimming. It can easily penetrate such structural materials as wood or soft brick and has been known to perforate inferior concrete. The animal is susceptible to plague and frequently transmits the disease, through the medium of fleas, to human beings.

(*c*) *Mus alexandrinus.*—This rodent is known as the white-bellied rat, roof rat, cane-field rat, and tree rat. It is essentially a climbing rodent and will not burrow, but breeds and lives in double walls, ceilings, and loosely piled material. While often found in human habitations, especially in upper stories, it will live and increase in the fields and woods. It is more fastidious in its feeding habits than the Norway rat, being especially fond of grain and fruits. It is not so ferocious or cannibalistic as the Norway rat.

(*d*) *Mus rattus.*—This rodent is known as the black rat, East Indian rat, and also as the roof rat. Its habits are similar to those of *Mus alexandrinus.* It is susceptible to plague and frequently transmits the disease, through the medium of fleas, to human beings.

(*e*) *Mus musculus, or common house mouse.*—This animal is essentially domestic in its habits, breeding and living in one habitation. It does not migrate as do the large species of the Mus family and is not therefore a serious factor in the extension of plague.

See Public Health Bulletin No. 30, and reprints from Public Health Reports Nos. 119, 122, 135, 167, 182.

(*f*) *Charts showing rat and mouse catch.*—A chart showing the total rodent catch in a period of seven months' antiplague work in a large city. As the number of rats present becomes reduced as the result of trapping and poisoning, the number of mice increases until there are more mice caught than rats. The increase in the number of mice caught shows positively that the rat population is being reduced, as the larger species destroy mice.

(*g*) *Rat-proof vessel.*—As rats are carried from one port to another by ships, thus disseminating plague, it is advisable to limit as far as possible, this migration. A model of a rat-proof vessel is shown with the following features: All partitions and bulkheads are vermin proof. A fumigating furnace is installed on the deck for the production of sulphur dioxide or carbon monoxide. Pipes lead from this furnace to all compartments of the ship, thus making it easy to fumigate at frequent intervals. In order to prevent rats from boarding the vessel, the ship is fended off from the wharf by floating pontoons, rat guards are placed on all lines and the gangway is raised at night, or if left down is lighted and guarded. The quarters provided for the crew are furnished with wire sanitary overhead dunnage lockers. All stores are kept in rat and vermin proof compartments. The lifeboats are covered with tight-fitting tarpaulins to prevent their becoming rat infested. The wharf is also of rat-proof construction so that the danger of rats coming on board is minimized. If all wharves were so constructed and vessels kept free from rats, bubonic plague would not spread from one part of the world to another. (Cut 9.)

(*h*) *Rat guards.*—A full sized, one-piece rat guard is displayed attached to a 3-inch hawser stretched between two posts. This rat guard has a shield 3 feet in diameter maintained at all times in a position perpendicular to the line to which it is fastened. The prongs attached to the line by lashing are adjusted to any size line from one to six inches in diameter.

(*i*) *Public dock before and after rat proofing.*—The model shows a wharf, one side of which, from roof to foundation has been made rat proof; the opposite side being non-rat proof. On the non-rat-proof side are openings between the floor boards which allow the passage of rats and permit food to fall to the space beneath. The open space between the floor and the ground is an ideal feeding and breeding place for rodents, as it is easily accessible, dark, dry, and dusty, with plenty of available food. The rat-proof side shows a marginal wall of concrete extending two feet into the earth. The ends of the dock are protected by a similar wall. Two kinds of rat-proof flooring are installed, one of concrete six inches thick, and one of asphalt or creosoted wood blocks resting on a timber framework. There is a rat-proof chamber beneath this flooring, required for the structural protection of the bulkhead, composed of 8-inch creosoted timber.

(*j*) This model shows a section of a warehouse which is rat proof with the exception of the office portion. Its purpose is to demonstrate that every part of a building must be rat proof in order to achieve results. The rat-proof section is made up of walls laid in cement mortar, extending two feet into the ground; a concrete floor three inches thick with cement mortar wearing surface. The rooms are without ceilings, thus eliminating rat breeding and harboring space between ceilings and floors. The non-rat-proof features show: Electric conduit which may be climed by rats to reach the nonrat-proof office. The office has a double wall space between ceiling and floor above, and a wooden floor above concrete; between the double floors and ceiling space rat nests are shown.

(*k*) Two story grocery before and after rat proofing. In the "before rat-proofing" model numerous rat holes are seen leading to spaces between double walls and floors and ceilings containing rat nests. In the "after rat-proofing" model there is shown a metallic flashing extending 6 inches into the floor, and 12 inches upward behind the baseboard, in order to prevent the entrance of rodents into the wall space at the junction of the floor and wall. The space between the double wall is protected by a concrete base, 1 foot high; that between the floor and the ground has been filled.

(*l*) *Rat-proof sanitary stable.*—This model shows a concrete floor protected by a marginal wall of concrete extending 2 feet into the ground. The floor of the stalls slopes one eighth of an inch per foot toward a gutter in order to facilitate drainage, and removable wooden gratings are provided in stalls for the comfort of animals. The sewer drain is covered by a metallic grating. The manure pit is of concrete and has a self-closing metal lid, being thus rendered rat and fly proof. The feed box is metal-covered with a self-closing lid; mangers are metal-lined, 18 inches deep and slope from below upward.

(*m*) *Methods of rat proofing.*—This model shows two methods of rat proofing. The first; rat proofing by elevation, in which buildings are elevated not less than 18 inches from the most dependent timber to the ground, having the underpinning open and free on not less than three sides, so as to assure thorough exposure beneath the buildings. The second, rat proofing by marginal wall. This wall should be constructed of concrete or brick laid in cement mortar not less than 6 inches in thickness extending from the sill of the house to a depth of 2 feet below the ground level, and completely inclosing the space beneath the building. All necessary openings in the wall should be closed by perforated metallic plates or by galvanized wire screen, not less than 12 gauge, and openings should not exceed one-half inch in diameter. These models also show three methods of rat proofing a double wall: First, A brick fill extending 1 foot above the floor level. Second, A concrete fill extending 1 foot above the floor level. Third, Metallic flashing. Methods 1 and 2 are to be preferred. The above models of rat proofing are practicable only in buildings not used as food depots.

(*n*) *A rat-proof house.*—This model shows a rat-proof dwelling house, consisting of four rooms, bath, kitchen, and large basement. Foundation walls and ground areas are made so that it is impossible for rats to burrow underneath the building. All openings in the buildings are permanently closed or covered with screens. The walls and the floor of the basement are of concrete and there is no ceiling to the basement. The floors are lined with one-half inch mesh wire netting to prevent rats from gnawing through, and there is a galvanized-iron vermin strip under all walls. The eaves are closed to prevent rats from entering the attic. A closed metallic sanitary garbage can prevents rat attraction to food supply. See Reprint No. 122, Public Health Reports, describing rat proofing of buildings. (Cut 10.)

(*o*) *Rat-infested house.*—This is an ordinary frame building, so constructed that rats pass freely from one part to another through the spaces between partitions and openings left around sewer pipes, water pipes, etc. Numerous rats and rat holes are shown, as well as rat nests between the double walls. The barrel outside the kitchen window which is used for a garbage can offers a plentiful food supply easily accessible to rodents. (Cut 11.)

See reprints from Public Health Reports Nos. 119, 122, and 135.

(*p*) *The flea.*—An enlarged model of the rat flea (*Ceratophyllus fasciatus*), one of the intermediary hosts in the transmission of plague from rats to man, is shown. Fleas are flat, wingless insects. The adult female deposits her eggs among the hairs of the rat or other animal upon which she lives, but as these are not fastened to the hairs they soon fall to the ground. They hatch in from two to five days and become larvæ. The larvæ feed on almost any kind of refuse, the organic matter found in dust being sufficient for their sustenance. The larval stage lasts from one to three weeks, during

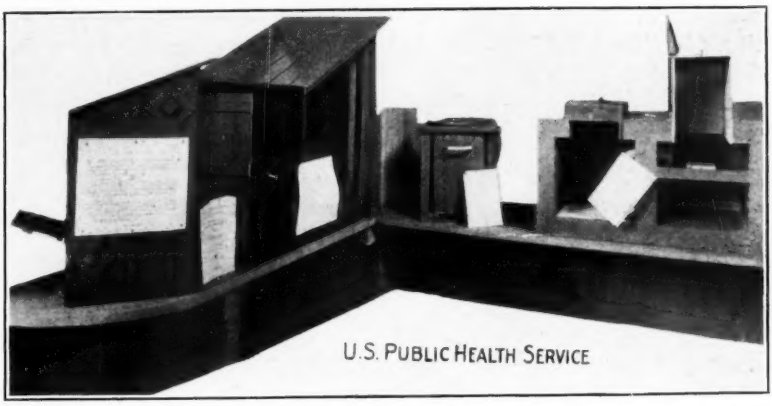

FIG. 8.—MODELS ILLUSTRATING METHODS FOR THE DISPOSAL OF EXCRETA.

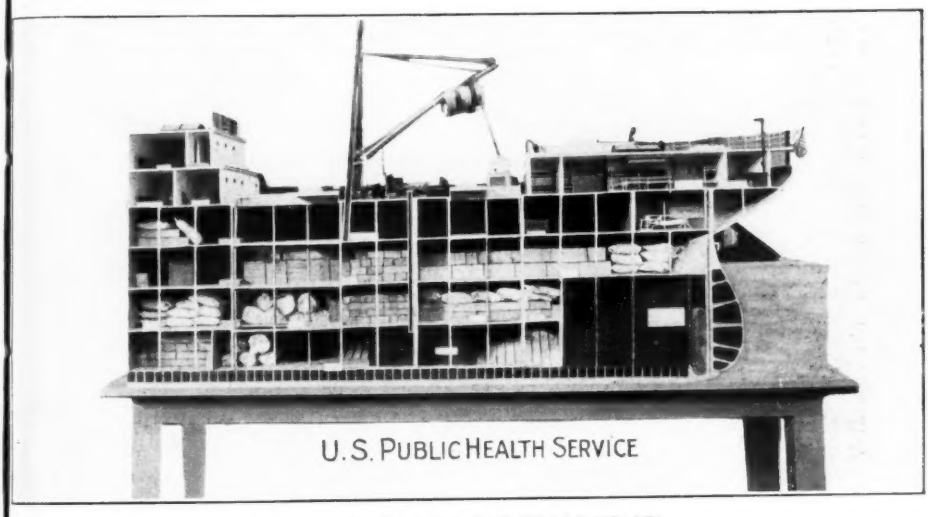

FIG. 9.—MODEL OF A RAT-PROOF VESSEL.

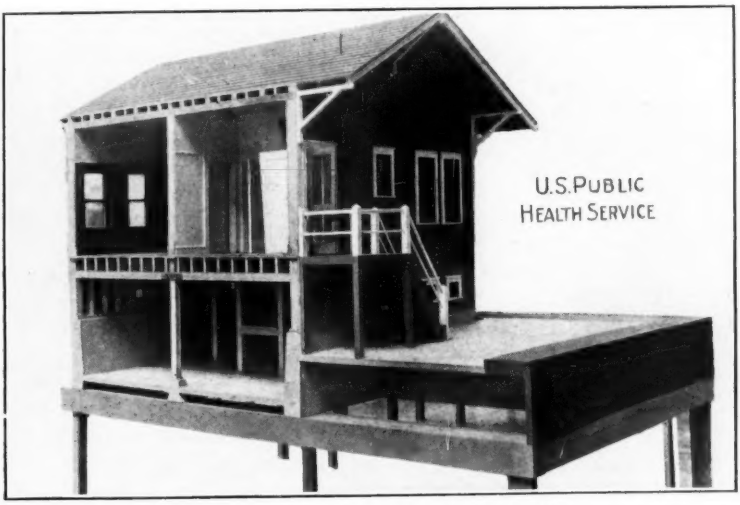

FIG. 10.—MODEL OF A RAT-PROOF HOUSE.

FIG. 11.—MODEL SHOWING A RAT-INFESTED HOUSE.

FIG. 12.—WAX MODELS OF NORMAL AND TRACHOMATOUS EYES.

FIG. 13.—PROPER AND IMPROPER MUZZLING OF DOGS.

which the skin is moulted three times. The larvæ then spin white, flat, silken cocoons in which they change into the pupa stage. The adult flea emerges from this cocoon in from five to eight days, depending upon the temperature. In warm, damp weather a generation may develop in 10 days. The leaping ability of fleas has been greatly exaggerated, as ordinarily they jump from 3 to 5 inches only. Fleas which have fed upon the blood of plague-infected rodents pierce the skin of man to obtain blood, and thus transmit plague to human beings.

See Public Health Bulletin No. 38; Reprints from Public Health Reports Nos. 31 and 38.

(*q*) *Bacillus pestis, the germ of bubonic plague.*—Glass models and a transparency of the *Bacillus pestis* are displayed. These organisms are short and rod shaped, and when stained by certain chemicals the stain concentrates at the end of the germ, giving it a bipolar appearance. The germs are present in the blood of an animal infected with plague and are taken into the body of a flea feeding upon a rat sick with the disease. The germs increase in number in the stomach of the flea to such an extent that the organ becomes distended and can not hold additional food. When a flea whose stomach is gorged with plague germs in this manner attempts to bite another rat or human being some of the plague organisms are forced out through the biting parts and are deposited in the wound made by the flea in piercing the skin. It is in this way that plague infection is transmitted from rat to man.

See reprints from Public Health Reports Nos. 88 and 90.

(*r*) *Pathological specimens of plague in guinea pigs and squirrels.*—These specimens were collected and prepared at the service laboratory in San Francisco. Attention is called to the abscesses in viscera, the reddened skin such as is found in plague in wild rats, and the large red and yellow swollen glands. In the squirrel the small yellow abscesses in the liver and spleen, the pin-point abscesses in the lungs, and the pus in the glands of the neck are demonstrated.

(*s*) *Ground squirrel* (*Citellus beechyi*).—This rodent is prevalent throughout the Western States and would be the means of disseminating plague infection broadcast over the region where it is found if precautionary measures were not taken. During the period from July 1, 1913, to November 1, 1914, the number of ground squirrels destroyed in California through the operations of the Public Health Service was estimated to be 21,925,449. A model is exhibited of a ground squirrel burrow, inhabited also by a booby owl and gopher snakes. The natural enemies of the ground squirrel, coyotes, foxes, owls, and certain kinds of snakes, are also exhibited.

(*t*) *Ground squirrel destructor.*—The Public Health Service's squirrel destructor, described in reprint from Public Health Reports No. 98, is demonstrated. The destructor employs either of two liquid preparations which are placed in the cup on the side of the instrument. The hose is inserted in the burrow and dirt is tamped around it to make the cavity air-tight. By pumping, the liquid is transformed into a deadly gas which anaesthetizes the animal and causes death in less than half an hour. The time required for the operation of the pump is less than one minute and the cost of material per individual burrow is under 1 cent.

See reprints from Public Health Reports Nos. 45 and 98 and California State Board of Health Bulletin, September, 1913.

(*u*) *Poisoned barley.*—A sample of this poisoned grain is exhibited, accompanied by the following printed formula:

Whole barley (recleaned)	18 pounds.
Strychnine sulphate	1 ounce.
Soda (bicarbonate)	1 ounce.
Saccharine	1 dram.
Thin starch paste	1 pint.
Corn sirup (Karo or equal)	2 ounces.

Dissolve the strychnine in hot water; thicken with starch to about the consistency of thin soup. Dissolve the soda in one-half pint of hot water and add a little at a time to the poisoned starch until effervescence ceases; then add the sirup and saccharine, mix well and apply to the grain, stirring constantly until the poison is evenly distributed throughout.

This formula is particularly advantageous on account of the fact that absorption of the poison through the cheek pouches of the squirrel occurs before the bitter taste is noted. Extensive experience with this type of poisoned barley has shown an efficiency far ahead of any other variety of poisoned grain tested. Young or half-grown squirrels have in most instances been practically exterminated, and the percentage of adults or full-grown squirrels destroyed is far higher than with other types of poisoned grain.

Yellow Fever.

The exhibits relative to yellow fever, a disease which has been absolutely conquered since 1900 through knowledge of its spread, were:

(*a*) A world map showing the distribution of the yellow-fever mosquito.

(*b*) An enlarged model of the *Aëdes calopus* mounted over a half barrel to show that the yellow-fever mosquito breeds only in artificial collections of water near human habitations. The eggs of this mosquito are deposited on the surface of the water, where they float separately, in a day or two hatching out into larvæ or "wiggle tails." When the larva of this species comes to the surface of the water to breathe it takes a position at about 45° to the surface. In a week the larva changes into a pupa, which lasts two or three days and ends in the birth of an adult mosquito. In order to transmit yellow fever from one person to another, the mosquito must bite a patient sick with the disease during the first three days of illness. The blood which she takes into her stomach contains the unknown organism of yellow fever, and this undergoes development in the mosquito's body and passes to the biting parts. After an interval of 12 days from the time the infected blood was taken the mosquito may infect non-immune persons.

Trachoma.

The communicable disease of the eyes, trachoma, or granulated lids, is prevalent in many sections of the United States, particularly in the Appalachian Mountain chain. The disease was demonstrated by enlarged wax models of the human eye, showing the natural condition of the conjunctiva of the upper lid when everted, the appearance during an active trachoma infection, and the condition after the active stage of the disease is passed and scar tissue has been formed. Charts relative to trachoma were also displayed. These included a trachoma catechism, giving information regarding the disease; what the health authorities should do to prevent trachoma; methods of spread of the infection in families and institutions; how to avoid the dissemination of the disease in institutions and schools; photographs of actual cases of trachoma before and after treatment; together with statistical information relating to the prevalence of the disease in various States and possessions of the United States and also in foreign countries.

(*a*) *Normal eye.*—This model shows the appearance of the normal eye when the upper lid is everted. It is necessary to turn the lid in this way in making an exami-

nation for the presence of trachoma, and this may easily be accomplished without discomfort to the patient. The conjunctiva or mucous membrane covering the eye and eyelid appears pink and small blood vessels may be seen.

(*b*) *Acute trachoma.*—When trachoma is present the conjunctiva or mucous membrane becomes inflamed and there is a development of new lymphoid cells and of an inflammatory exudate. These lymph cells, pressed out by the action of the inflammation, are collected by the pressure into little masses of a low order of vitality which act as foreign bodies. These trachoma follicles become surrounded by a capsule of inflammatory connective tissue well supplied with newly formed blood vessels, which causes a red appearance. The favorite site of these lesions is along the border of the cartilage of the upper lid and in the sac formed where the conjunctiva bends over to become the conjunctiva covering the eyeball.

(*c*) *Scar stage of trachoma.*—This follows the active stage and is an effort of nature toward cure. The amount of scar tissue formed depends upon the number of trachoma granules present and on the degree of inflammation. Scar formation begins to take place during the inflammatory stage, so that certain areas of the conjunctiva become smooth and white, although there may still be small areas of ulceration and trachoma granules. This causes the turning of the edge of the lid on account of the contraction of the scar tissue and produces entropion, together with ulcers, pannus, and other conditions. Many people are rendered totally blind by trachoma. (Cut 12.)

(*d*) *Trachoma catechism.*—Displayed with the above models is a trachoma catechism stating that the disease is dangerous; that it often impairs and destroys vision; that entire families or schools may become infected; and giving the common means of transferring the disease from one person to another.

(*e*) *What the health authorities should do to prevent trachoma.*—The disease should be made reportable to the health authorities; the eyes of school children should be regularly inspected; and the people should be taught through the press, by bulletins, and by popular lectures the dangers of the infection and the means of preventing it.

(*f*) *Methods of spread of trachoma in families and institutions.*—This chart is made up of three illustrations. The first illustration shows two children, one of whom is trachomatous and the other well, occupying the same bed. Flies are present passing from sick to well. The second illustration shows two children using the same towel and hand basin. The third shows three children playing in a room with unscreened windows. Flies, which act as carriers of the infection, are present.

(*g*) *Ways to prevent the spread of trachoma in institutions and schools.*—This chart is also made up of three illustrations. The first shows children occupying separate beds and with an absence of flies. The second, children using a sanitary wash room, the washing being done in running water. There are foot-pedal faucets, individual towels which have been boiled, and powdered soap in a sanitary container. The third illustration shows a trachomatous child being treated.

(*h*) *Trachoma, a communicable disease.*—This chart shows a log cabin with common washbasin and towel. Of the family of 12, all are suffering from trachoma.

(*i*) *Two actual cases of trachoma cured during United States Public Health Service campaign in Kentucky.*—A chart of four photographs, one being a photograph of an 11-year-old blind girl the day she applied for treatment. The second shows the same girl cured. The third and fourth are similar photographs of a man who had been practically blind as a result of this disease.

(*j*) Map of Louisville, Ky., giving the location of urban schools in which trachoma was found.

(*k*) Chart showing prevalence of trachoma among rural school children, Jefferson County, Ky.

(*l*) Map showing the counties of eastern Kentucky and the number of trachoma cases treated in the public health hospitals at Jackson, Hyden, and Hindman.

(*m*) *Prevalence of trachoma in the United States.*—A chart showing that of 165,907 persons, mostly school children, examined by the Public Health Service a percentage of infection of 1.44 was discovered, and that of 39,231 Indians examined the percentage of infection was found to be 22.7.

(*n*) Tables giving the prevalence of trachoma in 10 States of the United States.

(*o*) Similar tables of the prevalence of trachoma in the Philippine Islands, Porto Rico, Alaska, and Cuba.

(*p*) Prevalence of trachoma in certain European countries, Japan, and Egypt.

Tuberculosis.

A model of the Public Health Service Sanatorium at Fort Stanton, N. Mex., was displayed, together with large models of tent houses used at this institution. Statistical data in the form of charts showing the economic loss from tuberculosis were also exhibited, and a transparency demonstrating the tubercle bacillus.

(*a*) *Public Health Sanatorium at Fort Stanton, N. Mex.*—The sanatorium reservation has an altitude of 6,200 feet and contains 43 square miles, of which 200 acres are under cultivation. All buildings and tent houses are lighted by electricity. Rest, good food, and fresh air are principally depended upon as curative measures. See Reprints from Public Health Reports Nos. 93 and 145.

(*b*) *Fort Stanton tuberculosis tent house.*—The sole purpose of tents is to secure a maximum of ventilation. With this exhibit are given the regulations in force in the care of the tent house and the treatment of patients. See Reprints from Public Health Reports Nos. 93 and 154.

(*c*) Charts displayed with the sanatorium models show the results of treatment of various stages of tuberculosis at this institution. See Reprints from Public Health Reports Nos. 93 and 145.

(*d*) Estimates of economic loss from tuberculosis, giving the number of deaths in the United States from the disease, the average age at death, and the estimated monetary loss.

(*e*) *Transparency of the Bacillus tuberculosis.*—This organism causes the Great White Plague, tuberculosis, from which 142,970 persons died in the United States during the year 1913. Hygienic living conditions, good food, fresh air, and the destruction or disinfection of infectious sputum, are the great factors in preventing the spread of this disease. See Reprint from Public Health Reports No. 158, also supplement thereto No. 3.

Rabies.

Mounted dogs, showing proper and improper methods of muzzling, transparencies of Negri bodies, enlarged photographs of a dog in various stages of the disease, and data regarding the prevention of the infection comprised the exhibit relating to this disease.

(*a*) Two dogs are shown, the first properly and the second improperly muzzled. If all dogs had been properly muzzled the 45 deaths from rabies in the United States in 1913 would not have occurred. Improper muzzling gives a false sense of security, and many cases of rabies have resulted from the bites of improperly muzzled dogs. See Reprints from Public Health Reports No. 87, and Bulletin of the Hygienic Laboratory No. 65. (Cut 13.)

(*b*) *Negri body.*—A transparency of a Negri body, found in the brain cells of rabid dogs or other animals, is shown. The prompt use of antirabic virus has rendered rabies a disease of minor importance, measured by the number of deaths. A dog suspected of being rabid should not be killed after biting a person but should be cared

for to determine if death will occur, after which his brain should be sent to a laboratory for examination. See Hygienic Laboratory Bulletin No. 65. Reprint from Public Health Reports No. 87.

(*c*) Three enlarged photographs of a rabid dog upon the first, second, and fourth day of illness are displayed.

(*d*) *The prevention of hydrophobia.*—A chart giving the following data regarding the prevention of this disease is exhibited: The stray homeless dog must be painlessly put out of the way. High license fees for dogs should be established. The owners of dogs must be legally responsible for damage done by their animals. When rabies prevails in a district all dogs at large must be properly muzzled or must be led in leash, or both. All sick dogs, or those suspected of having rabies, should be confined and observed. Dog bites should be immediately cauterized. The head of a dog supposed to have rabies should be sent to an official laboratory for diagnosis. When suspicion of rabies in a biting animal is present the bitten person should seek medical advice as to taking the Pasteur treatment. The effect of the compulsory muzzling of dogs in England in the the eradication of hydrophobia is also illustrated by a chart.

Rocky Mountain Spotted Fever.

Rocky Mountain spotted fever, a recently discovered disease of man, prevalent in the Rocky Mountain region of the United States and transmitted through the bite of the wood tick (*Genus dermacentor*) was brought to the attention of the public by enlarged models of the male and female ticks, a map showing the distribution of the disease, and data regarding its prevention.

(*a*) *The tick that transmits Rocky Mountain spotted fever.*—The virus of the disease is perpetuated among the tick population by hereditary transmission and by conveyance through certain small animals during the feeding of immature ticks. An infective female tick transmits the infection to many of her progeny, and these usually retain the infection throughout the different stages of their development. The disease occurs principally in the spring or early summer and has a mortality of from 3 to 90 per cent, varying with the locality. See Hygienic Laboratory Bulleting No. 62 and Reprints from Public Health Reports Nos. 79, 139, and 179.

(*b*) *Distribution of Rocky Mountain spotted fever.*—A map showing the areas of known infection, comprising the States of Montana, Wyoming, Colorado, Idaho, Utah, Nevada, Washington, Oregon, and California, is shown. In certain districts of these States, the disease is of annual occurrence. In other districts isolated cases only have been reported. It will be impossible to determine whether Rocky Mountain spotted fever is spreading to uninfected areas in the Rocky Mountain region until complete morbidity and mortality records of this disease have been collected throughout the territory concerned for several years.

(*c*) *Prevention of Rocky Mountain spotted fever.*—Avoid being bitten by ticks in localities known to be infected. If possible, keep away from the woods and uncultivated lands during the spring and early summer. When able to do so, wear proper clothing as a partial protection. There should be as few openings as possible in the clothing below the collar band; boots, with trousers tucked in, or shoes with 4 to 6 inches of heavy woolen sock showing above the shoe tops, should be worn. The lower garments should always overlap the upper where they meet by several inches because the ticks nearly always crawl up. No clothing is completely tick proof, and where the danger from Rocky Mountain spotted fever is great one should strip and carefully search for ticks every two hours. Grease is one of the best preparations to release the attached ticks. See reprint from Public Health Reports No. 169.

(*d*) *The eradication of Rocky Mountain spotted fever.*—This depends upon the destruction of the infective wood ticks, accomplished by the clearing and cultivation of the land, by the systematic burning over of certain areas, by campaigns of extermination against small wild animals which serve as hosts for the immature ticks, and by the dipping of all domestic animals at regular intervals of 10 days during the tick season. Sheep properly grazed over a tick-infested territory will pick up practically all of the ticks and kill 90 per cent of them. See reprints from Public Health Reports No. 169.

Pellagra.

The exhibit relating to pellagra consisted of the following material: A map of the United States showing the distribution of the disease, the number of cases thereof among the white and colored population of various States, and an analysis of the total cases of pellagra reported in these States; a chart showing the increase in the cases of the disease during a five-year period; illustrations of the lesions of the disease; and a final chart giving other necessary information.

(*a*) *Distribution of pellagra in the United States.*—This map shows the disease to be prevalent in Texas, Louisiana, Arkansas, Mississippi, Alabama, Tennessee, Kentucky, Georgia, Florida, North Carolina, South Carolina, and Virginia. In all other States, with the exception of a few in the northwestern district, pellagra is sporadic.

(*b*) Number of cases reported by physicians in eight States, 1907 to 1911, inclusive, showing the death rate per hundred cases varying from 30 to 55 persons.

(*c*) Analysis of total cases of pellagra reported from eight States by sex, color, financial circumstances, and residence, whether urban or rural.

(*d*) Chart showing the increase in the number of cases of pellagra for the years 1907 to 1911, inclusive.

(*e*) Photographs of the lesions of pellagra on the wrist and the back of the neck.

(*f*) Chart showing that the disease is largely prevalent among the poor, 85 to 90 per cent of the cases occurring in this class. Studies made by the Public Health Service prove that pellagra is dependent on diet and that those who consume a varied mixed fare do not develop the disease. To prevent the disease, therefore, people must eat a variety of foods, which should include fresh meat, milk, beans, eggs, and peas. The disease is not infectious.

Diphtheria.

Glass models and a transparency of the *Bacillus diphtheriæ*, with data relative to the early use of antitoxin, constituted the exhibit relating to this disease.

(*a*) *Bacillus diphtheriæ, the organism causing diphtheria.*—This germ was discovered in 1883. It is found in the membranes of the throats of persons affected with diphtheria, and is frequently present in the secretions of the nose and throat, even after the infected person has recovered. In this way infection is spread from person to person. The germ may be transferred directly from one person to another by kissing, or by exposure to infected drops of sputum thrown out in the act of coughing, speaking, or sneezing; or it may be spread indirectly, especially among children, by using the same handkerchief, pencils, toys, or other objects. Milk and other foods may become infected with germs and thus transmit the disease. The organism is frail and soon dies when dried or exposed to sunlight. See Supplement to Public Health Reports Nos. 6 and 14.

(*b*) *Transparency of the Bacillus diphtheriæ.*—Prior to the discovery of antitoxin diphtheria caused thousands of deaths among children throughout the world. The

early use of antitoxin has reduced the death rate from 40 per cent to about 7 per cent. See Supplement to Public Health Reports No. 14.

(*c*) *Chances for recovery from diphtheria increased by the early use of antitoxin.*—This consists of a chart showing the increasing mortality from diphtheria when the use of antitoxin is delayed.

Typhus Fever.

While typhus fever is endemic in the United States its importance from a public health standpoint is far less than that of many other diseases. A map showing its prevalence throughout the world was displayed, together with an enlarged model of the body louse, the transmitter of the infection.

(*a*) *Distribution of the disease.*—A world map shows the distribution of typhus fever as it was officially reported in 1913, the countries in which it was found being as follows: British Isles, France, Spain, Hungary, Russia, Algeria, Egypt, Persia, India, China, Mexico, and the United States.

(*b*) *Means of spread of typhus fever.*—An enlarged model of the body louse (*Pediculus vestimenti*), the transmitter of typhus fever, is exhibited. Lice are flat, wingless insects with small heads and stout legs, parasitic during their entire lifetime on warm-blooded animals, including man. Lice usually walk sideways, but do not travel much and keep fairly close to the host. The eggs are fastened to the hair or clothing of the host and hatch in from 10 to 15 days. The young emerge from the top of the egg, differing but little in structure and appearance from the adults. Males are less numerous than females and are usually smaller. The mouth parts consist of a short beak through which extends a slender stylet which is used to pierce the skin of the host, so that blood may be sucked up through the proboscis. The bloodsucking habits of lice render them dangerous parasites and capable of transmitting disease from one host to another. See reprint from Public Health Reports No. 74.

Insects Carriers of Disease.

Colored photographs of the following insects were shown in a framed group:

Yellow fever mosquito (*Aëdes calopus*).
Malaria mosquito (*Anopheles maculipennis*).
House fly (*Musca domestica*). May carry the organisms of typhoid fever, cholera, and other diseases.
Tsetse fly (*Glossina palpalis*). Transmits sleeping sickness.
Tick (*Dermacentor andersoni*). Transmits Rocky Mountain Spotted fever.
Stable fly (*Stomoxyz calcitrans*). May transmit infantile paralysis.
Flea (*Xenopsylla cheopis*). Carrier of bubonic plague.
Body louse (*Pediculus vestimenti*). Transmits typhus fever.
Bed bug (*Cimex lectularius*). Transmits relapsing fever. (Cut 14.)

Smallpox and Vaccination.

Wax models illustrating the lesions of smallpox and contrasting them with typical vaccination lesions, were displayed, together with statistical comparison of the number of deaths from smallpox in several European countries with compulsory vaccination and those without compulsory vaccination, the years from 1886 to 1889, inclusive, being considered.

(*a*) Models showing the lesions of smallpox are contrasted with models of a typical vaccination. The eight wax models on the smallpox side of the case present the

lesions that occur during the course of this disease. The pitted appearance of the face of those who have suffered from smallpox is familiar to everyone. Before the introduction of vaccination in certain parts of Europe 90 per cent of all persons over 40 years of age were scarred by this disease. At present this disfigurement is comparatively infrequent. See reprint from Public Health Reports No. 60.

(*b*) Seven wax models depicting the appearance of a typical vaccination from day to day. See reprints from Public Health Reports No. 60.

(*c*) A chart is also displayed showing the deaths from smallpox in countries with compulsory vaccination and those without compulsory vaccination.

Countries with compulsory vaccination, average for each million of population: Sweden, 1; Ireland, 1; Scotland, 3; Germany, 3.5; England, 16.

Countries without compulsory vaccination, average for each million of population: Switzerland, 18.5; Belgium, 164; Russia, 231; Austria, 510; Italy, 536; Spain, 963.

The rate for the United States is not given because there are no national laws requiring vaccination. States, municipalities, school boards, and other organizations enforce certain requirements regarding vaccination. (Cut 15.)

Economic Loss During One Year to the United States through Preventable Diseases.

This was an allegorical group consisting of a figure of "Uncle Sam" and a dragon, a constant stream of money passing from the pocket of "Uncle Sam" to the mouth of the dragon, the figure representing the United States and the dragon the loss as a result of preventable diseases. The economic loss is just as real as if the money were actually taken out of the United States Treasury. This loss can not be prevented by National, State, or municipal health agencies without the intelligent cooperation of every citizen. With this group was given information concerning the exact monetary loss entailed by four of the principal diseases, viz: Tuberculosis, typhoid, malaria, and syphilis. With this data were given the number of cases and deaths, the average age at death, the loss in wages, the cost of medical treatment and nursing, and the value and potential value of the lives sacrificed.

Syphilis.

This disease was represented by a transparency of the causative organism. Information was also given regarding the number of cases of syphilis in the United States, its relation to insanity and paralysis, the value of the Wasserman blood test, and the necessity for the better education of the public regarding the means of transmission. See Supplement to Public Health Reports No. 13.

The Village of a Thousand Souls.

This model was supposed to demonstrate the number of deaths from certain diseases occurring among each 10,000 population residing in the United States. The model showed a typical country village of 275 houses. Certain of these houses in various parts of the village had different colored transparent roofs. Electric lights installed within flashed out consecutively and with each flash an automatic sign gave the death rate of the disease in question.

INSECT CARRIERS of DISEASE
Public Health Reports, Supplement 27.

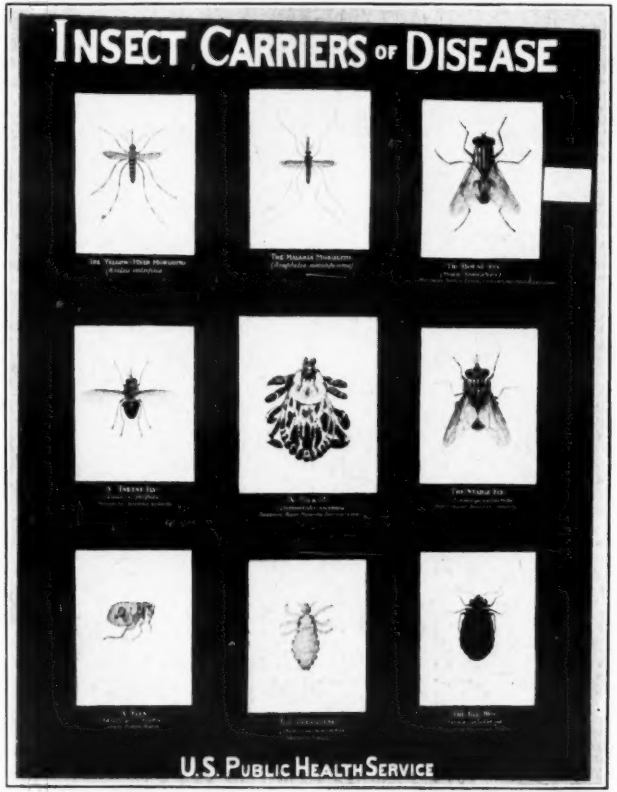

FIG. 14.—INSECT CARRIERS OF DISEASE.

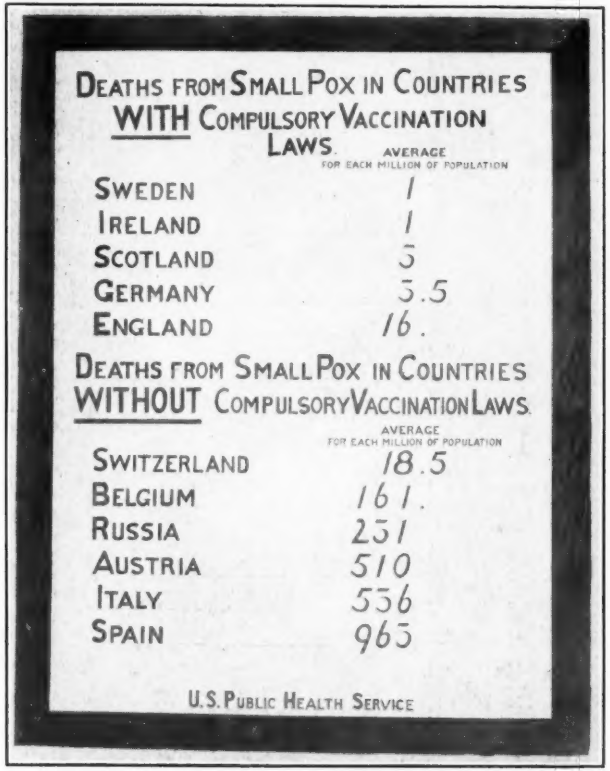

FIG. 15.—COMPARATIVE MORTALITY STATISTICS FROM SMALLPOX IN VACCINATED AND NONVACCINATED COUNTRIES.

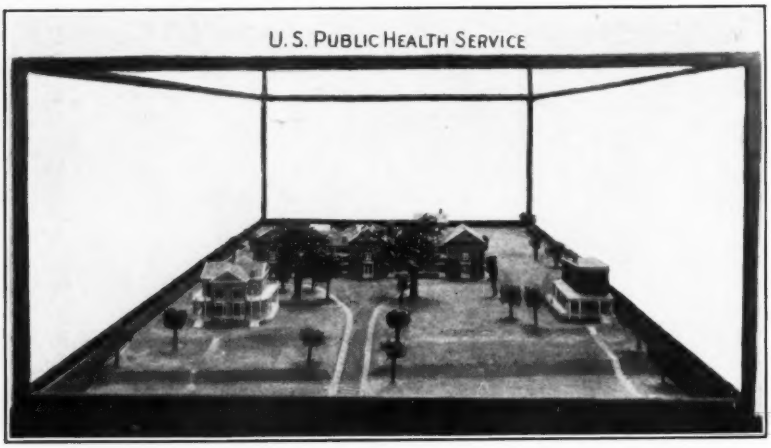

FIG. 16.—MODEL OF UNITED STATES MARINE HOSPITAL, STAPLETON, STATEN ISLAND, N. Y.

FIG. 17.—WORKING LABORATORY.

Mental Hygiene Exhibit.

Forty-six charts relating to mental hygiene were loaned to the Service for exhibition by the service officer on duty with the National Committee for Mental Hygiene. These charts were displayed on 11 screens and attracted a great amount of attention. Publications of the committee were also displayed and pamphlets were available for distribution. The charts gave information concerning the incidence of mental disease, the cost of caring for the insane, apparent increase in mental diseases, the changes associated with mental diseases, the relation of alcohol and syphilis to mental diseases, facts relating to immigration and eugenics, institutions for the insane, asylum care compared with hospital treatment, and delinquency and mental deficiency.

Service Stations.

The following models of service stations were displayed:

(*a*) Delaware Breakwater Quarantine Station.
(*b*) Camp Perry detention camp for yellow fever suspects.
(*c*) United States Marine Hospital, Stapleton, Staten Island, N. Y. (Cut 16.)

Working Model, Board of Health Laboratory.

An interesting and instructive feature of the service exhibit was an actual working model of a board of health laboratory. The laboratory occupied a space 24 by 28 feet and was fully equipped with all the latest and improved types of apparatus. Actual laboratory operations were carried on and visitors had the opportunity of obtaining information and witnessing laboratory procedure. (Cut 17.)

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